

Grandparent care:

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Grandparent care: A key factor in mothers' labour force participation in the UK

Abstract

The relationships between paid work and informal care are critical to understanding how paid work is made possible. An important source of childcare is the intergenerational care grandparents provide, specifically to assist parents to participate in paid work. Using data from the UK's Millennium Cohort Study, a nationally representative sample of children born in 2000, bivariate and IV analysis of mothers' participation (given the social construction of caring responsibility) identifies the significant causal effect of grandparents' care in raising mothers' participation by 12 percentage points (ATE), and around 33 percentage points for those receiving grandparent care (ATT). Distinguishing the effect sizes for lone and partnered mothers and those with different levels of educational attainment shows the need to distinguish the effect of grandparents' care by mothers' educational attainment. Grandparents' care enables participation rather than extending hours of mothers' work for those in work.

Introduction

Across western societies, grandparents play an important role in caring for their grandchildren. As with the unpaid work of women in the male breadwinner model (Folbre, 2001) the care grandparents provide is largely unrecognised and gendered in that it is mainly provided by grandmothers (Sear and Coall, 2011). Making visible this caring role is especially important in the UK where grandparents support high levels of mothers' participation in paid work but simultaneously face an extension of their own paid working lives from the raising of the state pension age (Pensions Act, 2011; 2014). Gray (2005) highlighted this tension a decade ago in this journal but the academic literature has paid surprisingly little subsequent attention.

From the angle of maternal employment, the contemporary UK context has increased in interest for two reasons. Firstly, mothers' participation has grown rapidly to reach 69.6% by 2014 (ONS, 2014). The participation of first-time mothers of babies under the age of one had even exceeded this figure, reaching 74% by the millennium (Author citation 1). Although part-time work for mothers has become normative in the UK (Himmelweit and Sigala, 2004), mothers' full-time employment has also increased (Soobedar, 2011) which has widened the range of participation between mothers. Grandparents' care is particularly relevant in this respect because previous studies associated it with a greater intensity of mothers' work (Dimova and Wolff, 2011).

Secondly, decisions about work and care in the UK have been made against the backdrop of some of the highest childcare costs in Europe (Kenjoh, 2005) and in sharp contrast to the recent situation in Germany. Childcare costs have significantly impacted women's participation (Del Boca and Vuri, 2007). The experience

elsewhere in Europe is that where there is a shortage of childcare or its cost is high, the intensity of grandparent care increases to fill the void (Attias-Donfut and Wolff, 2000).

Recent studies in European and North American contexts have started to make visible grandparents' specific role in raising mothers' labour force participation (Dimova and Wolff, 2008; 2011; Aassve, Arpino and Goisis, 2012; Compton and Pollack, 2014). These studies quantified an often substantial role of grandparents while highlighting considerable differences in the size of effects between countries. Further evidence of cross-country variation has been provided in comparative studies of the intensity of grandparent care (Igel and Szydlik, 2011; Di Gessa, Glaser, Price, Ribe, and Tinker, 2016).

This article investigates the effect of grandparents' care on mothers' paid work in terms of both participation (the extensive margin) and hours of work (the intensive margin) in the UK. Attention is on mothers because caring has largely been constructed as a maternal responsibility. The study focuses the analysis on mothers with at least one child of primary school entry age as childcare demands vary considerably with children's ages (see for example McKay's 2004 study of low-income families in the UK). The analysis addresses potential differences in grandparents' role in lone as opposed to dual-parent households, building on the potentially differential importance of grandparents in lone-mother and step-parent households (Attar-Schwartz, Tan, Buchanan, Flouri and Griggs, 2009; Ruiz and Silverstein, 2007; Henderson, Bert, Sanders and Loudon, 2009). The final investigation is of the impact of mothers' educational attainment on labour force participation.

Literature review and theoretical background

Grandparent care for grandchildren is much in evidence in European countries other than the UK. In their study of ten European countries using the Survey of Health, Ageing and Retirement in Europe (SHARE) data (which excludes the UK), Hank and Buber (2009) found a high prevalence of grandparent care even where they least expected it in Sweden, Denmark and France. In line with expectations because of limited publicly available childcare, the intensity of care was greatest in Italy, Spain and Greece.

The cross-country differences in grandparent care illustrate one aspect of how the welfare state context and features of the labour market influence the expression of intergenerational relationships (Szydlik, 2012). These institutional factors play an important role in the widely diverging patterns of grandparent participation, which do not readily conform to Esping-Anderson's European welfare-state typology (Aassve, Arpino and Goisis, 2012). According to Saraceno and Keck's (2010) categorisation of states based on the degree of familialisation, the UK fell into a medium category among the 26 EU member states with regard to the provision of childcare for children aged three to six years and with regard to the degree of public provision of childcare. The USA provides a still different view into how institutional and family cohesion condition outcomes across generations: grandparents were the main source of childcare for up to 23% of pre-schoolers (Laughlin, 2013).

Research quantifying the effect of grandparent care on mothers' labour force participation has varied in its findings. Dimova and Wolff's (2011) study, which pooled the SHARE data for ten countries, highlighted how grandparent care raised

maternal participation in paid work. Aassve et al.'s (2012) analysis of seven countries from the Gender and Generations Survey (again excluding the UK) found considerable variation across countries in whether grandparent care raised mothers' labour force participation: in France, Germany, Bulgaria and Hungary grandparent care had a positive and statistically significant impact on mothers' participation while in Russia, Georgia and the Netherlands it did not. In the Italian context of limited formal childcare, Arpino, Pronzato and Tavares (2014) found, using an instrumental variables approach, an extremely large effect: Italian mothers helped by grandparents were 32 percentage points more likely to work. A much smaller, but still important, effect of 5.1-6.2% was found in the USA for married women in receipt of grandparent care (Compton and Pollack, 2014).

It is well recognised that demographic changes have lengthened the opportunities for intergenerational relationships and exchange (Bengtson, 2001; Uhlenberg, 2005).

Grundy, Murphy and Shelton (1999) found that at age 20 over 80% of the population in the UK had a living grandparent. Tan et al.'s (2010) study reported that 94% of maternal grandmothers met their grandchildren at least twice a year, while 57% met on a weekly or daily basis. Cohort changes in age at first birth mean that on average grandparents in the UK had their children at younger ages than subsequent cohorts so that in terms of age today's grandparents are able to look after their grandchildren; an opportunity which may not endure (Gray, 2005; see also for Russia Utrata, 2011).

The grandparent literature categorises forms of intergenerational resource flow in terms of six distinct forms of solidarity comprised of different types of shared activities. Policy and institutional environments shape the type of assistance provided, so that where formal care is more available grandparents have channelled their

support into financial gifts and financial support (Dimova and Wolff, 2011).

Grandparents seem to provide care specifically to assist parents to work in the UK (La Valle, et al., 2000 and McKay, 2004). Examining European data from SHARE, Dimova and Wolff (2011) showed that the effect of care was to raise mothers' participation, in contrast to financial transfers from grandparents which did not raise participation.

We might therefore expect that grandparents' care is provided specifically to help mothers into work and that it raises mothers' participation, either through filling a care void or because parents prefer its relational qualities (Wheelock and Jones, 2002). This leads to the following hypotheses:

H1: Grandparents' childcare raises mothers' participation.

H2: Grandparents' care raises the extent of mothers' participation.

At least two competing explanations have been put forward for why grandparents provide care, based on exchange and altruism (Coall and Hertwig, 2010). Ample research in anthropology and sociology describes the subtlety and complexity of gift exchange. Bourdieu (1977) sets out how gift exchange, like social exchange, is enacted over time. This temporality would be manifest in the exchange of childcare which grandparents provide in return for elder care by parents and grandchildren.

Reciprocity forms part of the definition of functional solidarity, one of Bengtson and Robert's (1991) six components of intergenerational solidarity between adult children and their parents. Economists view this reciprocity as an intertemporal exchange in which parents invest in the expectation of future returns (Coall and Hertwig, 2010). Both economists and sociologists envisage alternatives to this kind of exchange thesis: for economists, grandparents could invest altruistically because their

grandchildren's utility enhances their own utility (Becker and Tomes, 1986). For sociologists, this is a form of unconditional solidarity.

The gendered nature of 'gift' exchanges that grandmothers provide to grandchildren had received little attention until Ashwin, Tartakovskaya, Ilyina and Lytkina (2013) argued that care contributions provided by women were so taken for granted that they did not demand reciprocation. The provision of care was not necessarily of unconditional solidarity or even altruism. Grandmothers' complaints about non-reciprocation from their daughters cast doubt on both altruism and reciprocation theories. Utrata (2011) argued that sometimes grandmothers feel compelled to provide informal childcare as part of the performance of doing both gender and age, which requires prioritising the interests of the younger generation. If this pressure does come to bear on older women we would expect a high proportion of grandmothers to provide care because it is normative.

The intergenerational decision-making process would be related to the opportunities and claims to resources of three generations: children, parents and grandparents (Hagestad, 2006). Testing this theory in practice requires empirical analyses which include characteristics of the three generations of grandparents, parents, and grandchildren, although the requisite data is rarely available in quantitative studies. However, pursuing this multi-generational approach, grandparents may be more likely to look after their grandchildren if the mother has a higher level of education. The intergenerational improvement in women's educational attainment means that in many cases mothers are likely to have higher attainment than grandparents. This leads us to the third hypothesis.

H3: Mothers' work opportunities, as demonstrated by educational attainment, condition whether grandparents provide care.

Grandparents' involvement also depends on family structure (Steinbach, 2012), with grandparents more involved when the mother does not have a partner. In the USA the prevalence of grandparent care for never married, divorced and separated mothers was found to be around 7 percentage points higher than in married mother households, based on analysis of 2008 data from the Survey of Income and Program Participation (Laughlin, 2013). Poorer families are less likely to be able to provide financial transfers thus providing care may be a more feasible method of providing intergenerational support, as Gray (2005) argued in relation to the UK.

In the UK, as elsewhere, household structure is related to poverty rates (Brewer and Gregg, 2002). The risk of poverty in lone parent households is particularly high, at 35%, and even higher, at 55% (Bradshaw, 2010), if the lone parent is not working. The relatively lower level of attainment (Kiernan and Smith, 2003; Author citation 2) and lesser labour force experience of women in the UK who start out as lone mothers presents formidable challenges to participating in paid work. Ho (2015) found that in the USA increases in lone mothers' income led to a decrease in grandparent provided care and increased uptake of formal care. A similar effect would result from lowering the cost of formal childcare. Indeed previous policies to reduce childcare costs for lower income families and lone mothers were successful in the UK: Francesconi and Van der Klaauw (2007) found that the childcare element in the Working Families' Tax Credit played a very important role in raising lone mothers' labour force participation. Similarly, Duncan, Paull and Taylor (2001) found childcare price had a

strongly negative affect on the probability of choosing formal care for both single parents and married women. In contrast, Viitanen (2005) found only a modest effect of childcare subsidies in the UK, suggesting that the relatively low childcare price elasticity of employment may be a result of a preference for relative care, as Wheelock and Jones (2002) also argued. An alternative explanation could relate to the shortage of childcare places. This leads to the fourth hypothesis.

H4: Grandparents' care makes a larger impact on the probability of lone mothers entering paid work than its impact on partnered mothers.

METHOD

Data

I used data from the Millennium Cohort Study (MCS), a nationally representative sample of babies born in the UK over a twelve-month period which started in 2000. The MCS is a stratified one-stage cluster sample with finite population sampling and varying probabilities of selection. The analysis used data from the third round of the survey (MCS3) which took place when the survey children entered primary school at around age five. The surveys comprised 12,013 partnered mothers and 2,938 lone mothers at MCS3. Details on the sample and attrition are provided in Plewis (2007). After listwise deletion of observations with any missing values on the variables of interest, the analysis used data from 14,429 mothers at MCS3. The use of mothers' attitudes from MCS1 was responsible for most of the reduction in the sample size.

Variables

Dependent variables

The first dependent variable was the *mother's paid work status*, which was set at zero if she was not working and one if she was in paid work.

The second dependent variable was the *mother's usual weekly hours* in paid work.

Key independent variables

Grandparent childcare. This variable for grandparent care was constructed from two MCS3 variables. The first relates to the situation where any of the grandparents look after the cohort member before or after school during a typical week as the first named source of care. The alternative sources of care were non-resident parents, the other parent, friends, other relatives, nursery or an after-school club. The second variable indicates if grandparents looked after the cohort child on the weekend. In both cases respondents are asked the question irrespective of whether the mother worked. The responses to these two variables were combined to make a dichotomous variable equal to one if the grandparents provided care. As a robustness check the variable was also coded as equal to one in the case where grandparents look after grandchildren on a weekday after school only. The results are comparable and reported below.

Grandmother's age. In recognition of Hagestad's (2006) call to include characteristics of all three generations I ran a separate regression (not reported because this variable was insignificant and required restricting the analysis to those with a living grandmother) with the cohort member's maternal grandmother's age in years in the grandparent care equation, as previous studies found that maternal grandmothers

provided the bulk of grandparent care (Aassve et al., 2012; author citation). Younger grandmothers may be more able to provide childcare than older ones.

Distance from grandparents. I constructed a continuous variable to measure distance from maternal grandparents as measured by travel time to grandparents. In their study of proximity of middle-aged couples to their parents based on the British Household Panel Survey, Chan and Ermisch (2015) found that having a child reduced the probability of living a long travel time from the woman's parents, but not from the man's parents. This finding suggests that the connections with the woman's parents are more critical in terms of being a grandparent who provides care. Compton and Pollack (2014) argued that geographical distance to mother or distance to the mother-in-law had an effect on mothers' labour force participation only through its effect on care. The variable is constructed as follows: zero equals grandparents are unavailable because they are no longer alive, have no relationship or are outside the UK; one equals grandparents living one hour or more away from grandparents but in the UK; two equals 30 to 60 minutes away; three equals 15 to 30 minutes away and four equals less than 15 minutes away. Chan and Ermisch (2015) dichotomised distance categories by whether the parents lived near (less than 15 minutes away) or further away, which seems unnecessarily restrictive in relation to whether grandparents can provide care.

Education. For educational attainment I used a five-category variable employing the UK's National Vocational Qualification (NVQ) scale. NVQ level zero covered those with no qualifications or qualifications obtained overseas (previous analysis suggested that the effects in this dataset are similar). NVQ1 encompassed qualifications of two GCSE passes at grades D-G, equating to twelve years of compulsory schooling.

NVQ2 included those with two GCSE passes at grades A-C. NVQ3 equates to A-levels or equivalent vocational qualification, equating to 14 years of schooling. NVQ4 categorised those with tertiary education, that is a degree, further degree, vocational degree, equivalent qualification in nursing or diploma in higher education.

Control variables

Child suffers if the mother works. Respondents were asked the question “A child is likely to suffer if his or her mother works before he/she starts school” and asked to indicate (1) *strongly agree*, (2) *agree*, (3) *neither agree nor disagree*, (4) *disagree*, (5) *strongly disagree* and (6) *can't say*. The answers *agree* and *strongly agree* were coded one, the other answers were coded zero. This measure is not ideal because the question was asked at MCS1 but is included because mothers' attitudes towards working have been found to be influential (Author citation 1). This question accounts for a part of what would otherwise be unobserved heterogeneity.

Urban-rural. Living in the major population centre of Greater London is an important predictor of employment (McKay, 2004) but is unavailable so I constructed a UK-wide variable for living in a rural or urban area (the reference category).

Number of children. Studies have shown that the number of children impacts women's participation. It may also impact the extent to which grandparents provide care (Gray, 2005). *Number of younger children.* An additional variable is included for the number of younger children, it is coded 0 if there are no younger children, 1 if there is one younger child and 2 if there are two or more younger children.

Analytic Approach

The analysis comprised three parts. First, I used descriptive statistics to explore the normativity of grandparent care, indicated by its prevalence. Significance of differences between lone and partnered mothers was tested.

In the second step I modelled participation using bivariate probit (with participation and grandparent care equations) and instrumental variables approaches. If unobserved characteristics determined both grandparents' provision of care and mothers' labour force participation, then univariate probit or logit estimation would result in significant bias. A positive correlation between the provision of grandparent care and mother's participation would result if a latent factor such as parental support facilitated a mother's participation and also the likelihood of grandparent care. A negative could result if grandparents provided care to mothers with lesser educational attainment, and thus less access to formal care, who were less likely to be in work as previous studies of the UK have shown (author citation 1; 2). A further explanation could be a mismatch in values regarding childcare between mothers who wanted to work and their parents who were less likely to provide childcare. The test for this endogeneity was if the error terms in equations specifying participation and grandparent care were correlated (Wooldridge, 2002).

The advantage of the bivariate probit model was that the coefficient of grandparent care in the participation equation was net of grandparent care selectivity effects. The causal effect of grandparent care on mothers' participation is the average effect of grandparent care on participation for those who lived close to grandparents but would not have worked otherwise, excluding those who would have worked anyway. By contrast, the IV estimator measures the effect of grandparent care on all those who received it "compliers", the local average treatment effect (LATE) and the average

treatment on the treated (ATT) (Angrist, Imbens and Rubin, 1996) which Arpino, Pronzato and Tavares (2014) show coincide in the case of grandparent care. The results of Angrist (1996) depend on the monotonicity requirement that there should be no defiers, that is those who take the treatment of grandparent care when they are not assigned to the treatment group. In our case it is unlikely that when grandparents live far away that mothers would still be able to take the grandparent care treatment thus the monotonicity requirement is satisfied.

A potential source of bias is that heteroskedasticity of the jointly distributed error terms in the bivariate probit model could result in biased estimates of the ATE (Chiburis, Das and Lokshin, 2012). The alternative is IV estimation which is consistent for the local average treatment effect. As heteroskedasticity was found, both bivariate probit and IV estimation were reported and the results used to gauge the level of bias.

I employed distance from maternal (and in robustness checks, paternal parents) as an instrument because it had little bearing on mothers' labour force participation but directly influenced grandparents' provision of care, as found by Compton and Pollack (2014). Indeed, the correlation between travel time from maternal grandparents and mothers' labour force participation was only 0.07, while the correlation between giving care and travel time from maternal grandparents was 0.27. The data provided the unusual opportunity to verify if parents had intentionally moved close to grandparents which would risk invalidating the instrument. This was not the case as only 3% of parents cited the desire to move close to relatives as one of their reasons for moving even though 49% of children experienced at least one house move by their fifth birthday (Ketende, McDonald and Joshi, 2010). Similarly Del Boca, Piazzalunga

and Pronzata (2014) reported that only 3.2 % of mothers had moved to be nearer their family or friends in the two years surrounding the birth of a child and 1.2% had moved in with family, based on analysis of the British Household Panel Survey. Further confidence in the validity of the instrument comes from controls of educational attainment and mother's age which could be related to mothers living close to the maternal grandmother and also directly affect the outcome of mothers' employment decision (see Del Boca, Piazzalunga and Pronzata, 2014).

The third stage in the analysis was to model the impact of grandparent care on mothers' hours of work (the intrinsic margin). I used an instrumental variables approach to model the outcome accounting for the potential endogeneity of grandparent care, again using distance from grandchild, although in this case a binary variable (in effect a treatment variable) was constructed which distinguished those living close enough to use grandparent care. Although *grandparent care* is binary, Heckman and Robb (1985) show that OLS estimates are consistent in such cases.

The model is executed using Stata's *ivregress* command which calculates mothers' working hours and grandparent care equations simultaneously and provides corrected standard errors. We confined the analysis of working hours to working mothers because our interest was in whether mothers were enabled to work longer hours, conditional on their working. A Tobit model would take into account censoring on the dependent variable and in effect average across working and non-working mothers.

In order to account for differences between mothers in different educational groups and to distinguish between lone and partnered mothers, the average marginal effects of grandparent care (the average of the marginal effects calculated for each mother) on the participation of women with selected characteristics were reported.

RESULTS

Descriptive Analyses of Mothers' Participation and Grandparent Care

The summary statistics in Table 1 showed that by MCS3 grandparents were providing 36.1% of the before or after-school care during the school week or weekend care for lone mothers and 32.4% for partnered mothers, regardless of whether the mother was working. An additional 2.9% of children were looked after by a childminder who was named as the first source of before or after-school care and the grandparent as the second source of out of school care. The proportions of grandparent care were higher for working partnered mothers at 38.8% and 45.1% for working lone mothers (not shown in the table). The very high levels of grandparent provided care for working and non-working mothers lend support to the idea put forward in H1 that grandparent care is normative in the UK.

Table 1. Summary statistics for lone and partnered mothers.

MCS3 All mothers	Lone mothers	Partnered mothers
Mother's age	31.16 (6.29)	34.69 (5.55)
Grandmother's age	54.86 (8.79)	60.75 (8.40)
No of children	2.17 (1.17)	2.42 (1.00)
<i>Percentages</i>		
In work	41.06	60.54
Full-time work	15.25	18.40
No qualifications or overseas	22.80	11.72
NVQ1	11.38	6.67
NVQ2	31.89	27.47
NVQ3	13.51	14.70
NVQ4	20.42	39.44
Grandparent provided care	36.07	32.40
No younger children	71.54	55.45
1 younger child	23.05	37.43
2+ younger children	5.41	7.12
Distance from maternal grandmother(s)		
Outside UK or not applicable	20.62	19.48
One hour or more away in UK	12.40	18.13
One hour to 30 minutes away	8.63	8.00
30 minutes to 15 minutes	14.90	14.63
15 minutes or less	43.44	39.76
Distance from paternal grandmother(s)		
Outside the UK or not applicable	NA	32.05
One hour or more away in UK	NA	16.92
One hour to 30 minutes away	NA	7.28
30 minutes to 15 minutes	NA	12.16
15 minutes or less	NA	31.59

(weighted results; standard deviation in parentheses)

It was striking that a very high proportion of both lone and partnered mothers lived close to the maternal grandparents: 43.4% of lone and 39.8% of partnered mothers lived less than 15 minutes away from the maternal grandparents. These findings were consistent with Murphy, Grundy and Shelton's estimate (1999) of 60% of 30-50 year olds living within 30 minutes' travel time of their mother. The data from the MCS showed that a lower proportion of paternal grandparents lived nearby the cohort child than maternal grandparents, consistent with Chan and Ermisch's (2015) finding that there is greater proximity to maternal grandparents. Nonetheless paternal grandparents also lived in proximity with over 50% of couples who are parents living within an hour from the male partner's parent. In Table 1 the category outside the UK or not applicable applies to about 20% of children, included in this category are 6.8% of children who had a maternal grandmother who lived outside the UK, the rest of the category applies to those who report no relationship with their mothers or whose mother has died.

The survey data did not provide full details of which grandparent provided after-school care at MCS3. At MCS1 maternal grandfathers provided 8.2% of the care in working lone mother households, compared to 3.1% for working partnered mothers; for lone mothers, other relatives and friends filled the part that male partners played in their children's care. The proportion of working lone mothers who used formal care when the child was around nine months old was actually slightly higher (34%) than that of partnered mothers (32%), bearing out Duncan et al.'s (2001) finding that similar proportions of lone and partnered mothers used formal care. Furthermore Ho's (2015) research on the USA showed that lone mothers did not choose grandparent care because they were averse to formal childcare.

Multivariate Results

The value of rho showed a significant and high degree of negative correlation between the residuals of the participation and grandparent care equations, which implied that a variable that makes mothers more likely to participate in the labour market also made them less likely to receive grandparent care. Because we are using data with clustering, which means the observations are not independent, we cannot compute a true likelihood ratio, but instead compute the pseudo-likelihood (see Sribney, 2013). The modified Hosmer Lemeshow test of goodness of implied significant correlation in the error terms.

Notwithstanding its advantages the bivariate probit model can be at significant risk of providing biased estimates if heteroskedasticity is present. I rejected the null hypothesis of no significant deviation from normality of the jointly distributed error term based on the Murphy score test (Murphy, 2007), $\chi^2(9) = 65.98$, $\text{Prob} > \chi^2 = 0.0000$; the result implied excess kurtosis and skewness, which could introduce significant bias into the parameter estimates (Chiburis, Das and Lokshin, 2012). In order to correct for heteroskedasticity in the error terms and to gain some insight into the degree of bias in the bivariate probit model estimates, I also employed an instrumental variables regression with robust standard errors. The endogeneity of grandparent care is, as in the biprobit model, established. The robust score test (see Wooldridge, 2002) result again led to strong rejection of the null hypothesis that grandparent care was exogenous $F(1, 14388) = 28.32$ ($p=0.000$). The Stock Yogo (Staiger and Stock, 1997) test of weak instruments was strongly rejected, the F statistic (minimum eigenvalue) of 736 is substantially over the critical value of 10 suggested by Staiger and Stock (1997) when there is one endogenous regressor.

Comparison of the marginal success probability in the participation equation of the bivariate probit model with the estimates of the IV model in Table 2 presents only minor variation in parameter estimates although as would be expected there were substantial differences in standard errors. The limited difference in the parameter estimates provided reassurance that the bivariate probit estimates were not substantially biased and that the causal effect of grandparent care on mothers' labour force participation, estimated at 11.9 percentage points through the bivariate probit model, was not substantially biased. A further robustness check involved running the grandparent care variable only including before and after-school care during the school week (excluding weekend care), the level of the effect was calculated at 10.66% reinforcing that weekend grandparent provided care also impacts mothers' participation.

In the models reported in Table 2, as we would expect based on previous analyses, mothers of young children in the UK were much more likely to be in work at higher levels of education (author citation 1). The participation of mothers is substantially higher in all groups relative to the reference category of no education and is particularly elevated for those who have had some kind of tertiary education. In comparative analysis, Kenjoh (2005) found a particularly strong effect of education on the odds of working full-time in the UK, which is interpreted to be a result of the especially low level of state intervention to support lower income women into employment (see also Joshi et al., 1996). Mothers' participation increases with age up to a certain point where it starts to diminish. Lone mothers are about 10 percentage points less likely to be in work controlling for age and educational attainment, narrowing the 20 percentage points raw difference between lone and partnered mothers, as the summary statistics in Table 1 indicated.

Table 2. The effect of grandparent care on mothers' participation: biprobit and instrumental variables estimates

	Bivariate probit regression						Instrumental variables regression	
	B		SE	ME		SE	B	SE
<i>Mother in work equation</i>								
<i>Ref: no qualification</i>								
NVQ1	0.331	***	0.066	0.107	***	0.021	0.106	*** 0.017
NVQ2	0.509	***	0.048	0.165	***	0.016	0.185	*** 0.013
NVQ3	0.706	***	0.054	0.228	***	0.019	0.256	*** 0.014
Degree level	0.883	***	0.051	0.282	***	0.018	0.314	*** 0.012
Mother's age	0.172	***	0.025	0.052	***	0.007	0.061	*** 0.006
Mother's age sq	-0.002	***	0.000	-0.001	***	0.000	-0.001	*** 0.000
Lone mother	-0.397	***	0.039	-0.123	***	0.012	-0.132	*** 0.010
Grandparent care	1.082	***	0.085	0.315	***	0.034	0.333	*** 0.036
Number of children	-0.184	***	0.019	-0.056	***	0.006	-0.063	*** 0.004
<i>Ref: no younger children</i>								
1 younger child	-0.313		0.032	-0.097	***	0.010	-0.088	*** 0.009
2+ younger children	-0.509		0.063	-0.159	***	0.020	-0.169	*** 0.016
Child suffers	-0.462	***	0.032	-0.143	***	0.012	-0.158	*** 0.009
Constant	-3.558	***	0.412		***			
<i>Grandparent care equation</i>								
<i>Ref: no qualification</i>								
NVQ1	0.019		0.066					
NVQ2	0.202	***	0.043		***			
NVQ3	0.229	***	0.050		***			
Degree level	0.168	***	0.045		***			
Mother's age	0.037		0.024					
Mother's age sq	-0.001		0.000					
Lone mother	-0.027		0.036		***			
Grandmother distance	0.192	***	0.010		***			
No of children	-0.158	***	0.015					
Grandparents' together	0.118	***	0.025					
Constant	-0.971	***	0.401					
Athrho	-0.425	***	0.080					
Rho	-0.401		0.059					
Observations	14429						14429	

*p<.05. **p<.01. ***p<.001. The column headed ME provides the marginal probabilities of mothers working. The average marginal effect of grandparent care on the probability that the mother is working – the conditional probability of working given grandparent care minus the conditional probability of working given no grandparent care, letting grandparent care = 0 and 1 for each observation, is calculated at 15%. Analyses performed using svy command with Stata 12. Robust standard errors.

Perhaps counter-intuitively, but supporting Aassve et al. (2012) for France, the results of the grandparent care equation in the biprobit specification in Table 2 indicated that mothers were more likely to be in receipt of grandparent care if they had attained NVQ3 over NVQ2 and less likely to receive grandparent care if they had attained NVQ4 over NVQ2. Dimova and Wolff (2007) found that more highly-educated mothers were more likely to be provided with grandmother care, although Arpino, Pronzato and Tavares (2014) found that less educated mothers were more likely to receive grandparent care in Italy. Although we cannot directly compare the educational attainment of grandparent-mother 'diads' as in Dimova and Wolff (2007), it seems likely that mothers have better work prospects than the grandparents (largely grandmothers) because of the strong cohort effect on women's educational attainment as well as their age or youth advantage in the labour market (Utrata, 2011). In terms of H3 it is not a straightforward story of higher education leading to more grandparent care. Consistent with the findings of Dimova and Wolff (2011) I interpreted the educational gradient as meaning that intergenerational care was on average motivated by the desire to help mothers into work, which supports H1. There was no evidence that the age of the grandmother impacted the provision of grandparent care (results not reported). In line with other studies, the presence of more children was associated with lower participation and also with a lower likelihood of grandparents providing care (tests for the endogeneity of additional children were rejected). Our results further echoed Aassve et al.'s (2012) finding that the provision of grandparent care is not strongly associated with mothers' characteristics, based on the seven countries of the Gender and Generations Survey.

An interesting side issue is the significance of grandparents living together.

Grandfathers were the main care provider for over 8% of lone mothers at MCS1 while

the presence of both grandparents may facilitate one of them providing care. The relevance of grandfather's presence is consistent with Glaser et al. (2010) who show that older people with more resources, for example those with a partner or with higher levels of wealth or educational attainment, are more likely to provide help; those in poor health or single are less likely to provide support. Hank and Buber's (2009) study found that the presence of a partner for grandmothers was not significant in whether they provided care, which would support the interpretation that if grandfathers' role is important it is through the direct provision of care.

Most importantly these results show the substantial impact of grandparent-provided care in the UK. The instrumental variables regression estimates the LATE at 33.3 percentage points, in the bivariate model the effect of grandparent care on the marginal probability of working given that grandparent care was available was estimated at 31.5 percentage points. The unconditional average causal effect of grandparent care on raising mothers' participation estimated by the biprobit model was 11.86 percentage points. Table 3 differentiates the strength of the average marginal effect at different values of the explanatory variables: lone and partnered mothers and different levels of educational attainment. The results show that education generally outweighs partnership status. Interestingly grandparent care raised the probability of mothers' working most at NVQ3, equivalent to A-level qualifications. A high proportion, 22.8% of lone mothers have no qualifications which implies a much lower probability of working. Grandparents' care raised the participation of mothers without qualifications by 9.3 percentage points for partnered mothers and 8.0 percentage points for lone mothers. This effect should be interpreted against their much lower probabilities of working.

Table 3. Biprobit average marginal effects for lone and partnered mothers as at different levels of educational attainment.

Educational attainment	Partnered mothers		Lone mothers	
	AME	SE	AME	SE
No qualifications	0.093	0.009	0.080	0.007
2 GCSEs grade D-E	0.107	0.014	0.104	0.011
2 GCSEs grade A-C	0.131	0.017	0.135	0.014
A-level	0.145	0.017	0.130	0.018
Degree level	0.140	0.018	0.120	0.018

Instrumental variables regression of the working hours of mothers conditional on their working shows no impact of grandparent care on the working hours of those already in work (results available in Appendix 1). Tests of the instrument confirmed that the equation was not weakly identified.

Conclusion

The results of this analysis clearly show that grandparents in the UK have played an important role in mothers' labor force participation. Grandparent care raised the participation of mothers who took up grandparent care by 33 percentage points (LATE), which is very much in line with the effect of 32 percentage points that Arpino et al. (2014) found for Italy and much higher than the 6% effect that Compton and Pollack (2014) found for the USA. Participation of mothers is much higher in the UK than Italy underlining that participation is about both finding a job and having access to care. In the UK, the causal effect of grandparent care on the labor force participation of mothers with at least one child in the school entry age group (age four to five in the UK) was 12 percentage points (AME), which is substantial given the overall participation rate of 56.17% at MCS3. The lower participation rate of mothers

with one child of school entry age illustrates how the age of children affect mothers' labour market outcomes.

Until now grandparents' role has been unquantified and largely peripheral to discussions about mothers' participation in the UK. It is increasingly untenable to ignore the extent of the effect of grandparent care when the circumstances affecting the supply of that care are changing. Gray (2005) argued the implications of providing grandparent care have not figured in plans for achieving increased participation for older people, an issue that is pressing as deferment of the state pension is enforced under the Pensions Acts of 2011 and 2015. Grandmothers who provide care may already be in a precarious financial position because of a weak labour market position caused by prior participation in care. Not enough is known about the opportunities for caregiving grandparents to continue in paid work, and the potential conflicts between providing unpaid care and trying to participate in paid work.

The analysis underscored that grandparent care plays an important role for mothers at all levels of qualification. While it raised the probability of participating by around 14 percentage points for mothers with NVQ4 (equivalent to degree level qualifications), it also made a substantial impact on mothers' without qualifications raising their probability of participating by 8 percentage points for lone mothers and 9 percentage points for partnered mothers against much lower starting probabilities of participating. The larger size of the percentage point impact on participation at higher education groups is consistent with previous research such as Dimova and Wolff's (2011) study of SHARE. The importance of grandparent care was underscored for lone mothers for whom participation is more challenging, not least because of substantial differences in observable educational and age characteristics. The significant impact of grandparent

care at all education levels is likely to mask differences in the circumstances in which that care is given, the provision of grandparent care for mothers without qualifications may present a more difficult challenge than that provided for mothers with higher level qualifications. We simply do not know enough about the type and extent of grandparent care and its implications for those in different socio-economic circumstances. Further research is clearly required.

The role that grandparent care plays in extending mothers' hours at work has received little attention as Aassve et al. (2012) and Dimova and Wolff (2011) have previously noted. Using the MCS data I found that grandparents care did not extend mothers' hours for those already in work consistent with Compton and Pollack's (2014) analysis of the USA. Dimova and Wolff's (2012) analysis of pooled European countries found that grandparent care was associated with a higher degree of participation, but their ordered probit analysis also partly measured participation.

Policies which rely on transferring responsibilities for childcare to grandparents are likely to have had profound effects on grandparents, especially grandmothers, and on intergenerational relationships. This is a prime example of how the political structures the personal. There is conflicting evidence of whether parents use grandparent care because they prefer it as Wheelock and Jones (2002) argue or because they lack childcare alternatives. Further research is required to settle this important question. However, the evidence is clear that working parents in the UK rely heavily on grandparents and the degree of intergenerational solidarity is surprisingly high in what many regard as a liberal market economy.

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Appendix 1: Instrumental variables regression of the effect of grandparent care on mothers' hours worked.

	B	Robust SE	
Grandparent care	-1.415	1.064	
<hr/>			
Education level			
No qualification			
NVQM1	-0.984	0.774	
NVQM2	0.066	0.596	
NVQM3	1.771	0.617	***
NVQM4	2.932	0.575	***
Mother's age	-0.117	0.224	
Mother's age squared	0.002	0.003	
Lone mother	1.184	0.363	***
No of children	-1.378	0.166	***
Child suffers	-3.046	0.360	***
Constant	27.404	3.900	
Observations	8162.000		

